Original Article

Symptom trajectories and influencing factors of prostate cancer following radical prostatectomy in Chinese patients

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Background: Patients following radical prostatectomy will encounter various symptoms that may vary depending on the recovery of surgery and the use of adjuvant treatments. However, few studies have used the scale developed for prostate cancer to longitudinally assess the course of symptoms in Chinese patients. This study aimed to identify the symptom trajectories and the influencing factors in the prostate cancer patients of our area.

Methods: A prospective observational study was conducted, and 155 patients with prostate cancer from 3 hospitals in Shanghai were recruited. Demographic and disease-related information was collected during the hospitalization. Further information on symptoms, adjuvant treatment, and functional exercise was collected across 4 time points. Growth mixture modeling was used to identify the trajectory patterns of symptoms, and logistic regression was used to determine the predictors.

Results: A total of 143 patients completed the investigation of all points, with a lost-to-follow-up rate of 7.7%. Urinary incontinence, urinary tract irritation, sexual dysfunction, pelvic pain, and hormone related symptoms all had group heterogeneity, and the number of latent category trajectories obtained was 4, 3, 3, 4, and 3 respectively. There were differences in demographic, disease, and treatment-related information between the groups.

Conclusions: Patients with prostate cancer have different symptom levels across different periods after radical prostatectomy. Medical staff can predict these changes based on the initial level of symptoms and related factors such as age, prostate volume, medical comorbidities, drug of adjuvant treatment to clarify the critical points, populations, and symptoms that require monitoring during follow-up.

Keywords: Prostate cancer; radical prostatectomy; symptom; influencing factor

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Introduction

Prostate cancer is one of the most common malignant tumors in middle-aged and older men. According to data from the Global Cancer Center, its incidence ranked second among male malignancies in 2018 (1). Although it was originally a low-incidence cancer in China, the incidence of prostate cancer has increased rapidly over the past 20 years and is more evident in developed areas such as Shanghai (2). Radical prostatectomy is the most important curative treatment for prostate cancer and is sometimes supplemented by endocrine, radiotherapy, and other treatments. Although the treated patients will experience excellent long-term survival (3), due to the progress of the

disease and the adverse effects of treatment, they will face various symptoms throughout treatment and rehabilitation process (4,5), with the more severe symptoms occurring in the short term after surgery (6). The Prostate Cancer Survivorship Care Guideline of American Cancer Society recommends that the impact of prostate cancer treatment be evaluated and managed (7). Additionally, The National Comprehensive Cancer Network has recommended that medical staff reevaluate the side effects at regular intervals according to the progress and severity (8). The U.S. National Cancer Institute (9) suggests paying close attention to the following 5 symptoms for localized prostate cancer: urinary incontinence, urinary tract stimulation, sexual dysfunction caused by surgical injury intestinal related symptoms, and hormonal related symptoms caused by adjuvant treatment. Previous studies have shown that the degree of symptoms and their changes over time are affected by many factors and show varied characteristics among different prostate cancer patients (4,6). Although there have been many studies on symptoms after radical prostatectomy, few studies have used the scale developed for prostate cancer to longitudinally assess the course of symptoms in Chinese patients or explore the differences between individual trajectories. Patients in different regions have different characteristics in terms of disease and treatment cycle. Therefore, this study aimed to identify the symptom trajectories and analyze the influence factors in China to provide practical guidance for medical staff in targeted symptom management. We present the following article in accordance with the STROBE reporting checklist (available at https://dx.doi.org/10.21037/apm-21-1229).

Methods

Study design and participants

This study was a prospective observational study. Data were collected at the following 4 points within 12 weeks: the first follow-up after discharge (T0), which was the time of catheter removal and starting adjuvant treatment, 4 weeks after T0 (T1), 8 weeks after T0 (T2), and 12 weeks after T0 (T3). Because the instrument assessed the symptom with 4 weeks, and the degree was the most evident this period. With convenience sampling, patients from 3 hospitals in Shanghai who met the inclusion criteria were recruited between September and November in 2020. The inclusion criteria were as follows: male sex, diagnosis with prostate cancer and underwent radical prostatectomy, no disease affecting the evaluation of symptoms, and willing to participate in this study. To obtain accurate data on urinary tract symptoms and eliminate the uncertain effects of unpromoted treatments, we excluded the patients whose catheter was not removed and who participated in the clinical trials for new drugs. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and was approved by the ethics committee of Huadong Hospital, Fudan University (20200032). We obtained written informed consent from each patient or a substitute decision-maker.

Measures

Demographics and clinical factors

Self-designed questionnaires were used for the collection of demographic and disease information including age, education level, body mass index (BMI) calculated by height and weight, smoking history, drinking history, medical comorbidities, prostate volume (PV), preoperative urinary tract symptoms, preoperative PSA, type of surgery, Gleason score, clinical stage (according to the American Joint Committee on Cancer 8th edition prostate cancer staging classification), postoperative adjuvant treatment, and postoperative pelvic floor muscle exercise (PFME).

Symptoms

The Chinese version of the Abbreviated Version of the Expanded Prostate Cancer Index Composite Instrument (EPIC-26) (10), a 5-dimension scale including urinary incontinence, urinary tract irritation, sexual dysfunction, intestinal related symptoms, hormonal related symptoms, was used in this study to assess symptoms. The score of each item ranges from 0 to 4 or 5, with a higher score indicating a worse symptom level. The EPIC-26 is a widely used scale and is recommended by the International Cancer Society for funded clinical trials and the International Health Outcome Measurement Consortium (9,11). As the focus of this study was to identify the trajectory patterns of 5 symptoms proposed by the U.S. National Cancer Institute, the score of the 5 subscales was used.

Data collection

During the hospitalization, the information was collected through searching the medical record system and through queries to family members. Information collected by these means was compared to ensure the authenticity of the data.

During the follow-up period, the patient's symptom level, adjuvant treatment, and functional exercise information were collected through a telephone call. If patients gave vague answer, we used rhetorical questions, reorganization, and summary to clarify their meaning. Among the patients we enrolled at T0, 143 people completed all investigations. According to Barcikowski and Robey, the sample size for this study was determined to be 142 (12) which means we met this requirement.

Statistical analysis

The difference between patients lost to follow-up and completed was compared through univariate analysis. Data from patients who completed all follow-up appointments were included in the analysis. Changes over time in each symptom were modeled separately using growth mixture modeling (GMM) that extracted participants' classes with similar trajectories. We examined the fit of each model using the robust maximum estimator, as it performs well in abnormally distributed data with a relatively small sample size. Akaike information criterion (AIC), Bayesian information criterion (BIC), and sample-size-adjusted BIC (aBIC) were used as the goodness-of-fit statistical measure, with smaller values suggesting a better model fit (13). Entropy was used to evaluate the accuracy of classification (14). After the best-fitting model, the most theoretically relevant and interpretable model was obtained for each symptom. Univariate analyses were then conducted. For quantitative variables, the cutoff point of age was determined by the cumulative frequency distribution table, and PV was used to delineate two groups, as has been done in previous studies (15). Any missing values were imputed by multiple imputations. All possible risk factors considered significant at a P value <0.1 were simultaneously input into multivariate logistic regression, with the worst trajectories being used as the reference. Analyses were performed with Mplus8 (Muthén & Muthén, Los Angeles, CA, USA) and SPSS20 (IBM Corp., Armonk, NY, USA). All tests were-2 tailed, and results with a P value less than 0.05 were considered statistically significant.

Results

Participants

Figure 1 shows the flow diagram for the study sample, and *Table 1* presents the participant demographic and clinical characteristics.

Change over time in symptoms

Growth mixture modeling resulted in 4, 3, 3, 4, and 3 class models selected as the final models for urinary incontinence, urinary tract irritation, sexual dysfunction, intestinal related symptoms, and hormone related symptoms. *Table 2* shows the model fit indices, *Figure 2* shows the scree plots, and *Figure 3* shows the estimated models for each symptom.

Urinary incontinence

Although the scree plot indicates that the inflection point was near 3 when the class number was 4, the differences of classes were more apparent, and the distribution of category probabilities was more reasonable. Therefore, the 4-class model was ultimately selected. All classes showed a downswing, and the number of patients in each class was similar. The class with the worst initial status showed a nonsignificant change, and patients with moderate initial level had a faster recovery.

Urinary tract irritation

Frequent micturition was the main symptom of this domain in this study. All the model fit indices indicated the 3-class model was the best fit. The level of "class 3" rose in the first period and then declined, and had the least number of patients. The other 2 classes both showed a downward trend over time. All classes showed nonsignificant change during the last period.

Sexual dysfunction

The inflection point of the scree plot was 3. In this case, the entropy was good, and the distribution of category probabilities was the most reasonable. Class 3 had most patients of the sample, with the worst initial status and a nonsignificant change. The other 2 classes showed a high initial level with a decrease and a low initial level with a slight increase, respectively.

Intestinal related symptoms

In our study, only 2 patients received radiotherapy and had no bowel symptoms. Scores in this domain were mainly from pelvic pain caused by surgical injury. The inflection point of the scree plot was 4. In this case, the entropy was good, and the distribution of category probabilities was

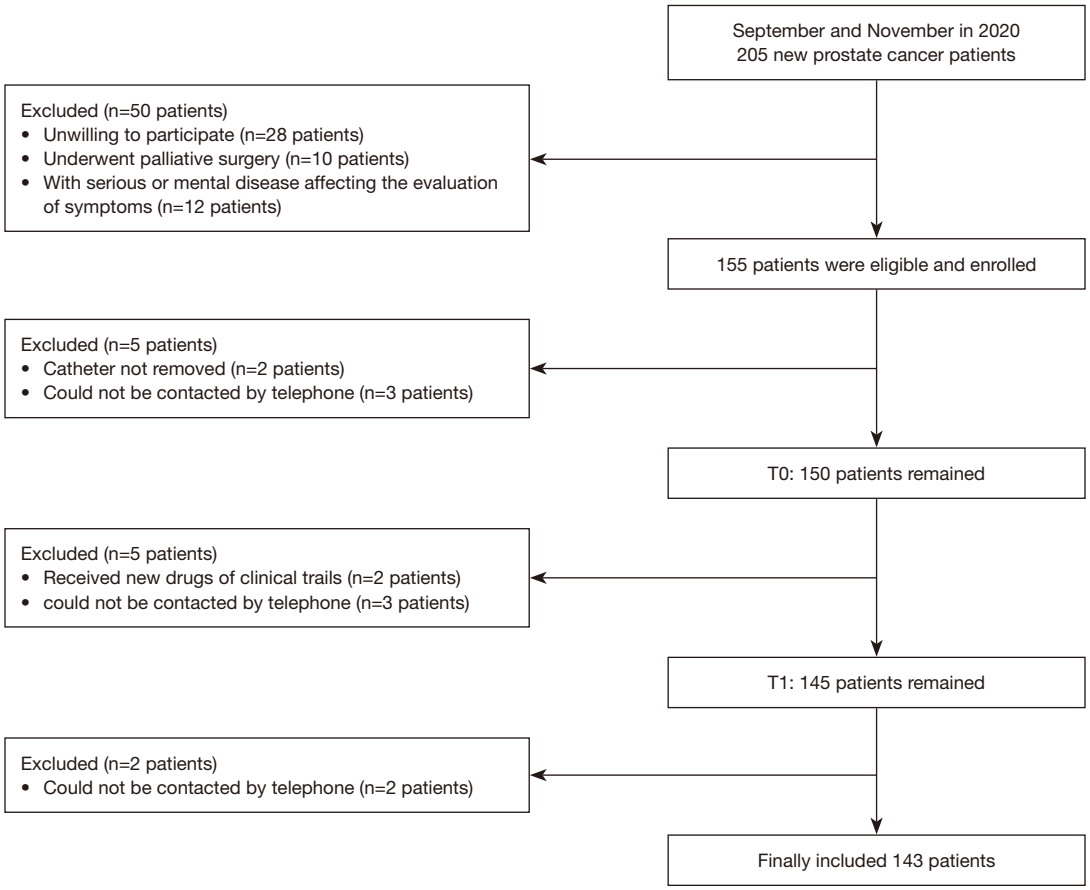

Figure 1 Flow diagram for the study sample.

reasonable. All classes showed a downswing. Class 1 had the most patients of the sample, with the lowest initial level and a return to 0 in the first period.

Hormone related symptoms

The inflection point of the scree plot was 4, but there was a category probability of 0. Both the entropy and the category probability were good when the class number was 3, so it was selected as the final model. Class 1 had the most patients of the sample, with the lowest initial level, a rise in the first period, and stabilization thereafter.

Predictors of class membership

Results from univariate analyses of variables are presented in *Table 3*. The predictive role of potential variables (P<0.1) to explain membership in trajectories was assessed through multinomial logistic regression, with the class with the highest score being selected as the class reference.

Urinary incontinence

Age, diabetes, PV, and PFME remained significant predictors in the final regression model, and the χ^2 test of the model was significant (P<0.01). Compared to class 4, young patients (age <65 years) were more likely to be class 1 [odds ratio (OR) =4.33; P=0.03] or class 2 (OR =3.04; P=0.04), and patients of class 3 had fewer diabetes (OR =3.72; P=0.05) and smaller PV (OR =0.21; P=0.04). Moreover, class 5 had more patients who did PFME.

Urinary tract irritation

Initial urinary incontinence remained a significant predictor in the final regression model, and the χ^2 test of the model was significant (P<0.01). Patients with lower levels of initial incontinence were more likely to be class 1 (OR =252.00;

Table 1 Demographic and clinical characteristics

Variable	N (%)
Age	
<65	41 (28.67)
65–71	61 (42.66)
>71	41 (28.67)
Education	
Primary school and below	18 (12.59)
Middle school	87 (60.84)
College and above	38 (26.57)
BMI (kg/m^2)[a]	
<18.5 (normal)	4 (2.80)
18.5–24 (overweight)	55 (38.46)
>24 (obese)	84 (58.74)
Smoking	
Yes	47 (32.87)
No	96 (67.13)
Drinking	
Yes	27 (32.87)
No	116 (67.13)
Medical comorbidities	
Diabetes	26 (18.18)
Hypertension	69 (48.25)
Cardiovascular and cerebrovascular diseases	20 (13.98)
Constipation	36 (25.17)
PV (cm^3)	
<50	105 (73.43)
≥50	20 (13.99)
Missing value	18 (12.59)
Preoperative urinary tract problems	
Dysuria	37 (25.87)
Pain on urination	7 (4.90)
Frequent micturition	45 (31.47)
Preoperative PSA (ng/mL)[b]	
<4	8 (5.59)
4–10	61 (42.66)
10–20	41 (28.67)
>20	27 (18.88)
Missing value	6 (4.20)
Operation type	
Open	15 (10.49)
Laparoscopic	60 (41.69)
Robot assisted	68 (47.55)
Postoperative Gleason score	
6	16 (11.19)
7	92 (64.34)
≥8	31 (21.68)
Missing value	4 (2.79)
Clinical stage	
Stage I	12 (8.39)
Stage II	74 (51.75)
Stage III or above	52 (36.36)
Missing value	5 (3.50)
Postoperative adjuvant therapy	
Endocrine therapy	
LHRH agonist	20 (13.99)
Antiandrogen/Antiandrogen + LHRH agonist	33 (23.08)
Radiotherapy	2 (1.40)
PFME	
No	35 (24.48)
Occasionally	71 (49.65)
Regularly	37 (25.87)

[a]According to Chinese adult weight criteria (2013 version); [b]According to clinically localized prostate cancer: American Urological Association guideline. BMI, body mass index; PV, prostate volume; PFME, pelvic floor muscle exercise.

P<0.01) or class 2 (OR =16.00, P=0.02) than they were to be class 3.

Sexual dysfunction

Age and drug of adjuvant endocrine treatment remained significant predictors in the final regression model, and the χ^2 test of the model was significant (P=0.01). Young patients (age <65 years) were more likely to be class 1 (OR =4.88; P=0.02) than they were to be class 3, and patients who received luteinizing hormone-releasing hormone (LHRH) agonist were more likely to be class 2 (OR =9.52,

Table 2 Summary of model fit indices

Symptom	Number of classes	LL	AIC	aBIC	Entropy	Classification probability
Urinary incontinence	1	–1,019.4	2,058.8	2,056.8		
	2	–1,007.2	2,042.4	2,039.6	0.752	0.556/0.444
	3	–973.6	1,979.2	1,975.6	0.997	0.133/0.531/0.336
	4	–950.2	1,944.4	1,940.0	0.96	0.216/0.146/0.315/0.323
Urinary tract irritation	1	–810.7	1,643.5	1,641.3		
	2	–795.9	1,623.7	1,620.5	0.734	0.618/0.382
	3	–789.2	1,620.3	1,602.1	0.772	0.561/0.074/0.365
	4	–779.1	1,610.2	1,604.9	0.72	0.260/0.153/0.463/0.124
Sexual dysfunction	1	–905.6	1,827.2	1,825.6		
	2	–409.3	1,156.7	1,154.5	1	0.077/0.923
	3	–372.9	773.9	771.0	0.999	0.769/0.077/0.154
	4	–302.9	639.9	636.5	0.999	0.007/0.154/0.077/0.762
Intestinal related symptoms	1	–453.6	929.1	926.9		
	2	–449.0	920.1	917.9	0.991	0.793/0.207
	3	–313.4	654.7	651.9	0.995	0.215/0.072/0.713
	4	–286.7	607.5	604.1	0.921	0.218/0.496/0.073/0.213
Hormone related symptoms	1	–585.7	1,193.5	1,191.3		
	2	–523.0	1,078.1	1,074.9	0.993	0.929/0.071
	3	–492.6	1,027.1	1,022.9	0.972	0.112/0.839/0.049
	4	–443.9	939.7	934.5	0.977	0.006/0.795/0/0.199

LL, Log likelihood; AIC, Akaike information criterion; aBIC, sample-size-adjusted BIC.

P=0.03) compared to those who received antiandrogen or antiandrogen plus LHRH agonist.

Pelvic pain

Constipation remained a significant predictor in the final regression model, and the χ^2 test of the model was significant (P<0.01). Patients without constipation were more likely to be class 1 (OR =13.20, P<0.01) than they were to be class 4.

Hormone related symptoms

The drug of adjuvant endocrine treatment remained a significant predictor in the final regression model, and the χ^2 test of the model was significant (P<0.01). Patients who received LHRH agonist were more likely to be class 2 (OR =34.74, P=0.03) than they were to be class 3, compared to those who received antiandrogen or antiandrogen plus LHRH agonist.

Discussion

To our knowledge, this is the first study to examine the subgroup trajectories of symptoms following radical prostatectomy in Chinese. We obtained the trajectory categories and influencing factors of the 5 symptoms, which may help researchers identify the symptoms, patients, and time points that need to be focused on visually.

Urinary incontinence

Our study found 4 classes for urinary incontinence with a class 4 of slow-changing and a class 3 of rapid-changing. Marzorati *et al.* (16) conducted a 5-point longitudinal study and identified

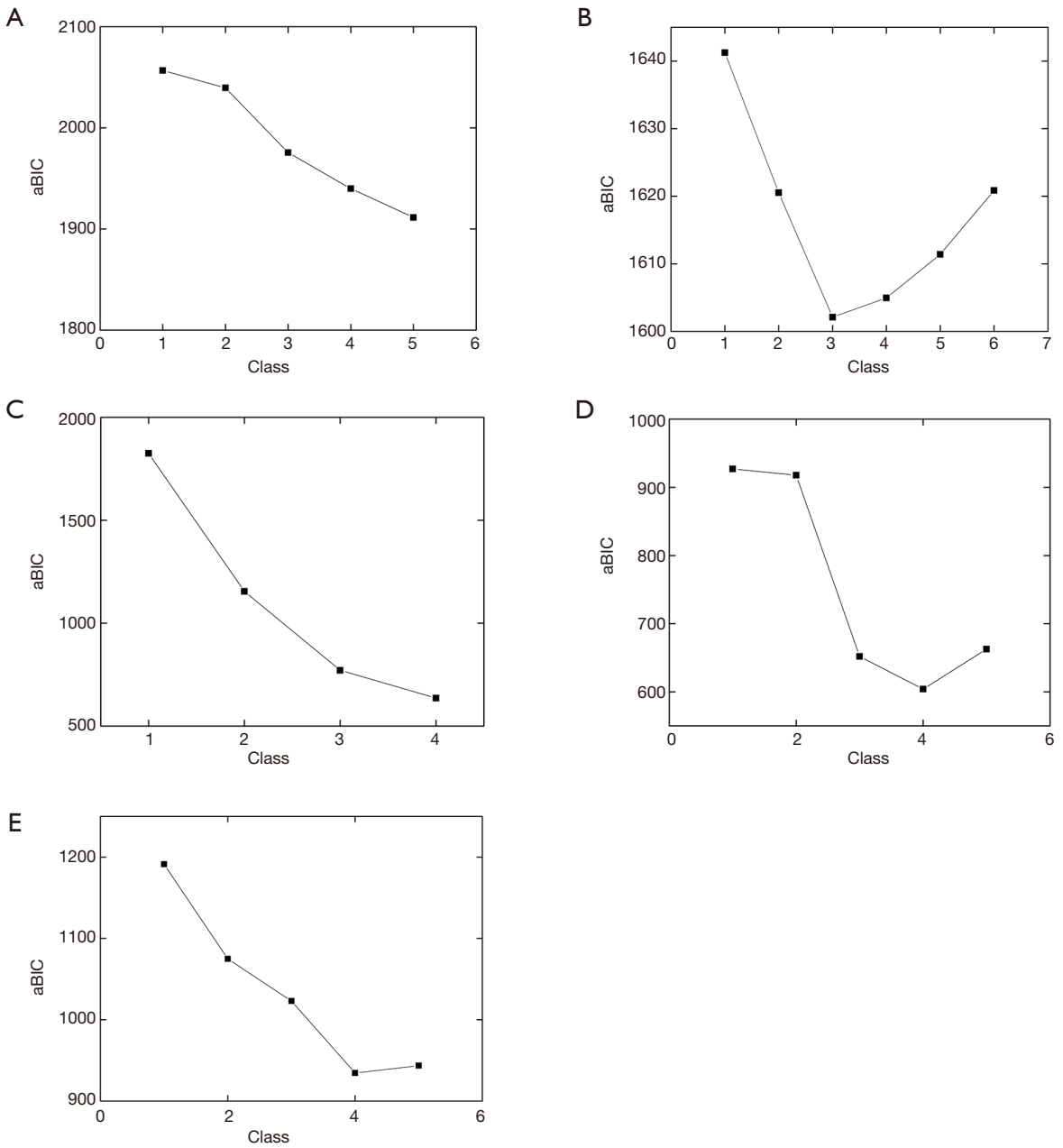

Figure 2 Scree plots for each model. (A) Urinary incontinence, (B) urinary tract irritation, (C) sexual dysfunction, (D) intestinal related symptoms, (E) hormone related symptoms. aBIC, sample-size-adjusted BIC.

a model with 5 classes, which also showed patients who had a high initial level of incontinence were likely to have a worse recovery. Our findings align with this study, which suggests that continuous evaluation and management should be done for patients with poor initial status who are older and have diabetes and bigger prostates. The relationships among age, diabetes, PV, and urinary incontinence have been clarified in a number of studies (17). There is a growing body of work suggesting that PFME is associated urination function; however, as the only controllable factor of urinary incontinence, it has an effect only in patients who do standardized exercises and persist 3 months (18). Our findings did not reveal a promotive effect of PFME for the improvement of urinary incontinence, but we found patients in other classes were less willing to do PFME

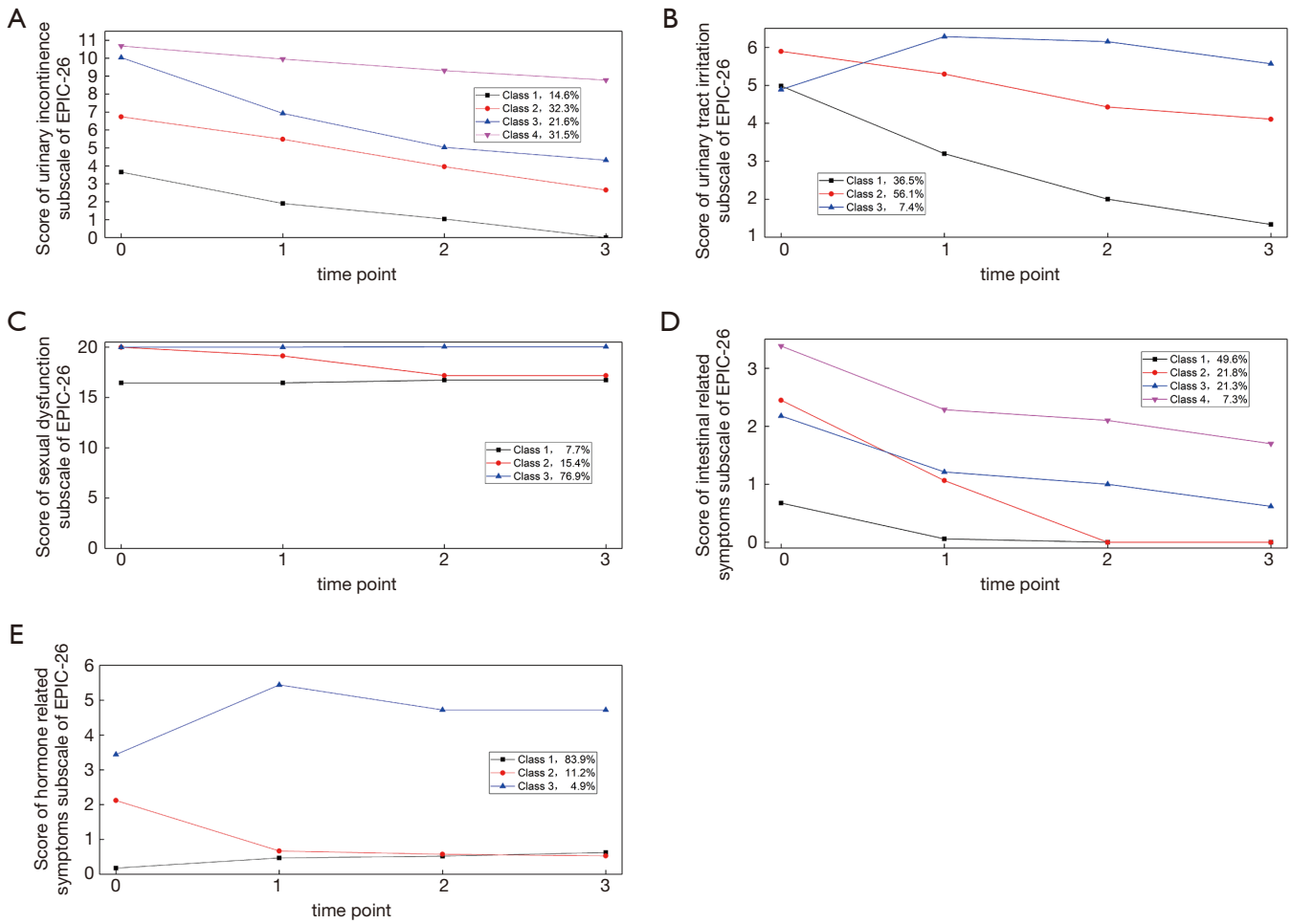

Figure 3 Estimated models for each symptom. (A) Urinary incontinence, (B) urinary tract irritation, (C) sexual dysfunction, (D) intestinal related symptoms, (E) hormone related symptoms. EPIC-26, Abbreviated Version of the Expanded Prostate Cancer Index Composite Instrument.

compared to class 4. In our study, only 25.87% of the patients persisted in PFME for 3 months. Many researchers have pointed out that correctly identifying the pelvic floor muscles and mastering the essentials of the exercise is difficult. These facts suggest that medical staff should pay attention to health education and behavioral supervision during follow-up and introduce patients with difficulty understanding the exercises to rehabilitation centers for professional training (19).

Urinary tract irritation

One class showed a trend of rising first and then falling, which was different from the trend of other classes, and it was dominated by patients with initially complete incontinence. For these patients, incontinence should be focused on first, and frequent micturition should be evaluated after incontinence has improved somewhat. Although univariate analysis showed that diabetes tended to affect urinary tract irritation, multivariate analysis did not. This discrepancy could be a result of strong collinearity between diabetes and urinary incontinence. However, it has been reported that diabetes could cause contractile dysfunction of the bladder, which has an influence both on frequent micturition and urinary incontinence (20).

Sexual dysfunction

The results of our study were similar to those of Marzorati *et al.* (16). Both of our studies fitted a 3-class model with a small absolute value of the slope, indicating that sexual

Table 3 Factors as univariate predictors of class membership

Predictor	Urinary incontinence					Urinary tract irritation				Sexual dysfunction				Intestinal related symptoms					Hormone related symptoms			
	Class 1	Class 2	Class 3	Class 4	P	Class 1	Class 2	Class 3	P	Class 1	Class 2	Class 3	P	Class 1	Class 2	Class 3	Class 4	P	Class 1	Class 2	Class 3	P
Age			0.03*				0.20				0.08					0.20				0.53		
<65	10	16	6	9		18	22	1		7	7	27		22	10	7	2		37	3	1	
65–71	7	16	12	26		15	41	5		4	15	83		31	12	16	2		48	9	4	
>71	4	14	14	9		17	21	3						19	8	7	7		36	3	2	
Operation type			0.01*				0.18				0.50					0.29				0.15		
Open	6	5	4	8		11	9	3		0	4	19		10	4	7	2		20	2	1	
Laparoscopic	8	21	15	16		17	39	4		5	11	44		26	18	12	4		49	10	1	
Robot assisted	7	20	13	20		22	36	2		6	7	47		36	8	11	5		52	3	5	
PFME			0.01*				0.53				0.96					0.67				0.12		
No	10	10	10	5		15	18	2		3	5	27		18	8	8	1		28	3	4	
Yes	11	36	22	39		35	66	7		8	17	83		54	22	22	10		93	12	3	
Diabetes			0.02*				<0.01*				0.62					0.92				0.94		
No	20	40	28	30		43	71	4		10	19	89		59	26	24	9		100	12	6	
Yes	1	6	4	14		7	13	5		1	3	21		13	4	6	2		21	3	1	
PV (cm^3)			0.05				0.49				0.12					0.77				0.98		
<50	19	36	23	41		35	63	7		10	17	78		47	24	25	9		88	12	5	
≥50	2	10	9	3		7	13	0		0	1	19		11	3	5	1		17	2	1	
Initial urinary incontinence			<0.01*				<0.01*				<0.01*					0.37				0.03*		
12	1	0	1	14		1	9	6		0	0	16		7	6	1	2		11	2	3	
8–12	0	0	31	29		7	51	2		0	10	50		30	10	14	6		49	9	2	
<8	20	46	0	1		42	24	1		11	12	44		35	14	15	3		61	4	2	
Postoperative adjuvant therapy			0.97				1.00				0.05*					0.28				<0.01*		
No	13	31	20	25		30	53	6		9	19	61		45	17	21	6		80	8	1	
LHRH agonist	3	6	4	7		7	12	1		1	2	17		9	8	1	2		13	6	1	
Antiandrogen/Antiandrogen + LHRH Agonist	4	9	8	12		12	19	2		1	1	31		17	5	8	3		27	1	5	
Constipation			0.51				0.60				0.39					<0.01*				0.38		
No	18	33	22	34		37	62	8		9	14	84		65	20	17	5		93	10	4	
Yes	3	13	10	10		13	22	1		2	8	26		6	11	13	6		28	5	3	

*P≤0.05. PFME, pelvic floor muscle exercise; PV, prostate volume; LHRH, luteinizing hormone releasing hormone.

dysfunction is a symptom of slow recovery. So this symptom may continue to exist for some time, medical staff should conduct continuous follow-up and management. In addition, because of its slow rate of change as compared with other symptoms, the follow-up frequency for sexual dysfunction can be appropriately reduced to limit the psychological burden caused by frequent evaluation. In our study, patients with persistently high levels of sexual dysfunction accounted for the most proportion of the total, while Marzorati *et al.*'s (16) study showed that most patients had recovery trajectories. This difference may be related to the lower disease severity of the patients in their study. The EPIC-26 not only assesses the severity of symptoms but also the degree of distress (21). Sexual dysfunction was the only symptom in this study where the distress and severity trended in different directions. Unlike the studies in Africa (22) and Canada (23), our study found that few patients considered sexual dysfunction to be a distressing symptom. However, patients with good initial levels showed increasing symptom distress as time elapsed, and these patients were typically of younger age. Symptom coping, including psychological care and corresponding medical resource introduction, should be provided to these patients. Compared those who received antiandrogen + LHRH agonist/antiandrogen, patients who received LHRH agonist showed a better trajectory, which was similar with the conclusion of Kim *et al.*'s (24) study, which reported that patients receiving antiandrogen + LHRH agonist had lower testosterone levels.

Pelvic pain

The class with a low initial level and a recovery at T1 accounted for the largest proportion of the total (49.6%). This shows that the pelvic pain was low and recovered quickly in most patients. This finding is consistent with the assertion from the Chinese Medical Association Anesthesiology Branch that acute pain caused by surgical trauma can resolve within 4 weeks (25). Furthermore, patients in all classes changed the most significantly in the first period, which is consistent with Sall *et al.*'s (26) study in which postoperative pelvic pain improved most considerably within 4 weeks, suggesting that 4 weeks after surgery is a critical period of concern for pelvic pain. The incidence of symptoms in this study was lower than that in Sall *et al.*'s study, which may be explained by the number of patients undergoing minimally invasive surgery in our study and the advancement of surgical techniques. We further found that constipation was an influencing factor of pelvic pain. Constipation is more common in elderly and postoperative patients. Guidance on defecation should be strengthened for these patients to prevent injury and pain caused by incorrect invasive operations. Mirzapour *et al.*'s (27) study points out that lying down, applying heat, and walking can help alleviate the pain in the pelvic area after radical prostatectomy.

Hormone related symptoms

Class 3, characterized by a low initial level and slow increase, had the highest proportion of patients, accounting for 83.5%% of the total. Class 2, characterized by a downswing in the first period and followed by a plateau, typically comprised patients who recovered from postoperative fatigue. Oliveira *et al.* (28) reported that fatigue after surgery in tumor patients decreased significantly in the first 2 months and persisted weekly thereafter. The trajectory of class 3 involved the highest initial level rise and then a plateau, suggesting that hormone symptoms in these patients are more obvious. Each class's symptoms changed markedly during the first period, suggesting that the first period is crucial for symptom management. Still, the symptoms persisted for an extended period, meaning long-term care is required, but the assessment interval may be delayed as appropriate due to the slow pace of symptom change. Type of endocrine therapy drug used was found to be an influencing factor of trajectory, patients who received antiandrogens were likely to have higher symptom level than those of LHRH agonist. This might be related to the feedback of androgen receptor antagonists causing increased testosterone, which causes breast development and tenderness, while LHRH not. However, our study did not find there to be a difference in the distribution of patients who did not receive endocrine therapy among the classes, which may be related to the large number of patients who did not receive it.

Conclusions

We enrolled the patients who received the most common curative treatment for prostate cancer, radical prostatectomy, as participants, and, using the 5 symptoms proposed by the American Cancer Institute for localized prostate cancer, we conducted a longitudinal investigation of the treatment cycle in which patients' symptoms were most apparent. Additionally, we used the growth mixture modeling to

identify the distinct symptom trajectories, which visually showed the symptoms, populations, and time points that need to be focused on. These findings may be helpful to health professionals in symptom management. Future research should develop and test targeted intervention packages for subgroups to achieve personalized care.

Limitations

Several limitations to our study should be mentioned. First, this study was conducted via a short-term follow-up of the participants; however, for sexual dysfunction and hormonal related symptoms, long-term management should be given. Next, although we examined all clinical stages and surgical procedures, the research was only carried out in Shanghai, and the participation of elderly patients with low education levels was lower, thereby limiting our findings' generalizability. Finally, due to many influencing factors, no covariates were added when fitting the model, and thus the results should be compared with future studies.

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Footnote

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